

# Renin-Angiotensin System Polymorphism modulates outdoor temperature related variation in blood pressure

**Yun-Chul Hong**, *Seoul National University College of Medicine, Republic of Korea*

**Ho Kim**, *Seoul National University School of Public Health, Republic of Korea*

**Younhee Lim**, *Seoul National University School of Public Health, Republic of Korea*

**Hyung-Jin Yoon**, *Seoul National University College of Medicine, Republic of Korea*

**Minseon Park**, *Seoul National University College of Medicine, Republic of Korea*

**Background and Aims:** Outdoor temperature related variation in blood pressure has been considered to play a role in excess cardiovascular mortality in extreme weather. The aim of this study is to evaluate the role of Renin-Angiotensin System gene polymorphisms (the Angiotensin converting enzyme (ACE) insertion/deletion (I/D), angiotensinogen (AGT) M235T, and angiotensin II type 1 receptor (AT1R) A1166C polymorphism) in modulating outdoor temperature dependent blood pressure (BP) responses.

**Methods:** Data including meteorological information, RAS gene polymorphisms, and BP were collected for 4,903 subjects from February 2003 to August 2004 in a university hospital. The generalized additive and linear models were used to examine the influence of genetic variants of RAS on the association between outdoor temperature and blood pressure

**Results:** Outdoor temperature ( $^{\circ}\text{C}$ ) was inversely associated with systolic BP (SBP) and diastolic BP (DBP) (SBP;  $\beta = -0.099$ ,  $p = 0.07$ , DBP;  $\beta = -0.100$ ,  $p = 0.006$ ). These inverse relationship were found to be stronger in the subjects with ACE DD, AGT TT and AT1R AA genotype (SBP;  $\beta = -0.416$ ,  $p = 0.003$ , DBP;  $\beta = -0.320$ ,  $p < 0.001$  for ACE DD, SBP;  $\beta = -0.204$ ,  $p = 0.003$ , DBP;  $\beta = -0.154$ ,  $p < 0.001$  for AGT TT, SBP;  $\beta = -0.133$ ,  $p = 0.024$ , DBP;  $\beta = -0.121$ ,  $p = 0.002$  for AT1R AA polymorphism). In the subjects with AT1R AC/CC polymorphism, significantly positive temperature-dependent BP responses were found in the temperature above  $21.4^{\circ}\text{C}$  (SBP;  $\beta = 2.208$ , DBP;  $\beta = 1.250$ , each  $p < 0.05$ ), but the associations disappeared in the temperature range below  $21.4^{\circ}\text{C}$  (SBP;  $\beta = -0.044$ , DBP;  $\beta = -0.020$ , each  $p > 0.05$ ).

**Conclusions:** This study suggests that RAS gene polymorphism modulates the relationship between outdoor temperature and BP. Genetic status of ACE DD, AGT TT and AT1R AA was associated with higher risk of blood pressure elevation when exposed to cold temperature, whereas AT1R genotype was found to be susceptible genotype for blood pressure elevation in hot temperature.

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